(19) Canadian Intellectual Property Office
An Agency of Industry Canada

Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

(11) CA 2 455 623 (13) A1
(40) 21.07.2005
(43) 21.07.2005

(12)

(21) 2 455 623

(51) Int. Cl. 7: B03B 9/02, B04C 9/00

(22) 21.01.2004

(71) ROMERO, JOY,
c/o Canadian Natural Resources Limited
Horizon Oil Sands Project, 900
311 - 6th Avenue S.W., CALGARY, A1 (CA).
TAYLOR, KEN,
c/o Canadian Natural Resources Limited
Horizon Oil Sands Project, 900
311 - 6th Avenue S.W., CALGARY, A1 (CA).

(72) ROMERO, JOY (CA).
TAYLOR, KEN (CA).

(74) PARLEE MCLAWS LLP

(54) SEPARATEUR A PLAQUES INCLINEES A CONTRE-COURANT A QUATRE ETAGES ET CIRCUIT CYCLONE
(54) FOUR STAGE COUNTER CURRENT INCLINED PLATE SEPARATOR AND CYCLONE CIRCUIT

Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2455623 A1 2005/07/21

(21) 2 455 623

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2004/01/21

(41) Mise à la disp. pub./Open to Public Insp.: 2005/07/21

(51) Cl.Int.^{7}/Int.Cl.^{7} B03B 9/02, B04C 9/00

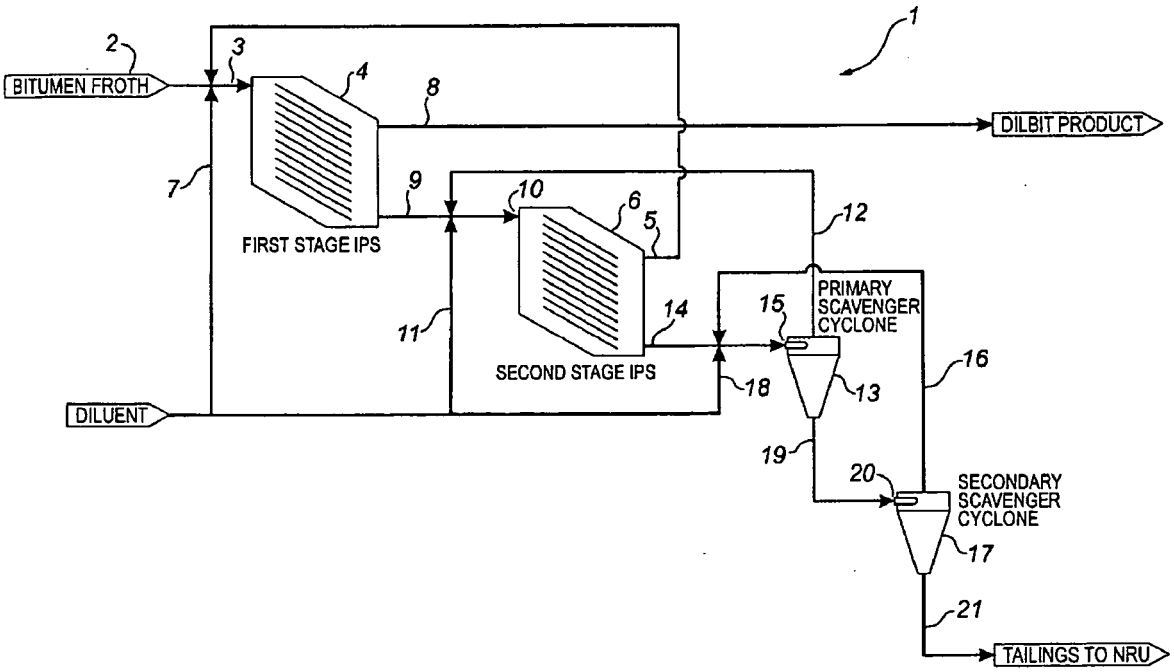
(71) Demandeurs/Applicants:
ROMERO, JOY, CA;
TAYLOR, KEN, CA

(72) Inventeurs/Inventors:
ROMERO, JOY, CA;
TAYLOR, KEN, CA

(74) Agent: PARLEE MCLAWS LLP

(54) Titre : SEPARATEUR A PLAQUES INCLINEES A CONTRE-COURANT A QUATRE ETAGES ET CIRCUIT CYCLONE

(54) Title: FOUR STAGE COUNTER CURRENT INCLINED PLATE SEPARATOR AND CYCLONE CIRCUIT



"FOUR STAGE COUNTER CURRENT INCLINED PLATE SEPARATOR and CYCLONE CIRCUIT"

FIELD OF THE INVENTION

The present invention relates to a circuit for cleaning bitumen froth by reducing the concentrations of contained water and solids contaminants.

BACKGROUND OF THE INVENTION

For many years now, bitumen has been recovered from oil sand using a water-based extraction and air flotation technique. More particularly:

- the as-mined oil sand is mixed with heated water to produce a slurry containing entrained air bubbles; and
- contained bitumen is recovered from the slurry in the form of a froth, by flotation.

The froth invariably contains varying concentrations of water and particulate solids contaminants. A typical froth might comprise:

bitumen -	60 % by wt.
water -	30 % by wt.
solids -	10 % by wt.

It is necessary to "clean" the froth by removing as much of the water and solids as one can feasibly manage, to prepare it for downstream upgrading.

The present invention is directed to providing a circuit for cleaning bitumen froth.

DESCRIPTION OF THE DRAWING

Figure 1 is a schematic flow diagram of the circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Having reference to Figure 1, a circuit 1 for cleaning bitumen froth 2 is provided. In the first stage of the circuit 1:

- bitumen froth 2 is pumped into the feed inlet 3 of a conventional primary inclined plate separator ("IPS") 4;
- overflow 5 from a secondary IPS 6 is recycled and is combined with the froth 2 fed to the primary IPS 4; and
- fresh light hydrocarbon diluent (e.g. naphtha) 7 is pumped and is combined with the bitumen froth 2 and overflow 5 that are fed to the primary IPS 4;
- whereby a diluent/bitumen ratio in the order of .65 - .75 is maintained in the mixture processed by the IPS 4.

By recycling secondary IPS overflow 5, the bitumen froth density is reduced, enhancing separation in the primary IPS 4. The primary IPS 4 functions to gravity separate water and solids from diluted bitumen. Typically, the IPS 4 contains parallel inclined plates spaced about 38 mm apart and angled at 55°. The overflow 8 from the primary IPS 4 constitutes the circuit product. Typically it contains 55 - 58 wt. % bitumen, 1.0 – 2.0 wt. % water, 0.5 - 1 wt. % solids with the remainder being diluent.

Carrying on now with describing the second stage of the circuit 1:

- The underflow 9 from the primary IPS 4 is pumped into the feed inlet 10 of the secondary IPS 6 ;
- Fresh diluent 11 is also pumped to the feed inlet 10 and is combined with the primary underflow 9; and
- the overflow 12 from a primary scavenger cyclone 13 is pumped to the secondary IPS inlet 10 and is combined with the underflow 9 and diluent 11;
- whereby a diluent/bitumen ratio in the order of 39 – 1.5 is maintained in the mixture processed by the secondary IPS 6 .

The secondary IPS 6 functions to recover residual bitumen from the mixture fed to it.

By recycling the secondary IPS overflow 5 to the primary IPS 4, bitumen lost with the primary underflow 9 may be recovered on the second pass through the primary IPS 4.

In the third stage of the circuit 1:

- the underflow 14 from the secondary IPS 6 is pumped into the inlet 15 of the primary scavenger cyclone 13;
- overflow 16 from a secondary scavenger cyclone 17 is recycled to the inlet 15 of the primary scavenger cyclone 13;
- fresh diluent 18 is also pumped to the inlet 15 and is combined with the secondary IPS underflow 14 and secondary scavenger cyclone overflow 16 ; and

- the primary scavenger cyclone overflow 12 is recycled to the secondary IPS inlet 10.

The increased separation force in the primary and secondary scavenger cyclones (13 and 17 respectively) scavenges the remaining bitumen by forcing the small diluted bitumen droplets to the cyclone overflows (12 and 16) where it can eventually be recovered as product from the first stage IPS 4. The increased force also removes more fine solids, sending them to tailings.

In the fourth stage of the circuit 1:

- the underflow 19 from the primary scavenger cyclone 13 is pumped into the inlet 20 of the secondary scavenger cyclone 17;
- the overflow 16 from the secondary cyclone 17 is recycled to the primary cyclone 13 , as previously described; and
- the underflow 21 from the secondary cyclone 17 is discarded as tails.

In summary, the circuit operates countercurrently and provides two stages of IPS's and two stages of cyclones in series. Fresh diluent is supplied to each of the IPS's and the secondary cyclone to mix with the bitumen increasing the difference in specific gravity between the water and diluted bitumen to allow the bitumen to have a greater chance of being recovered. The scavenger cyclones in series are used to increased the force available to separate the diluted bitumen, water and fine solids.

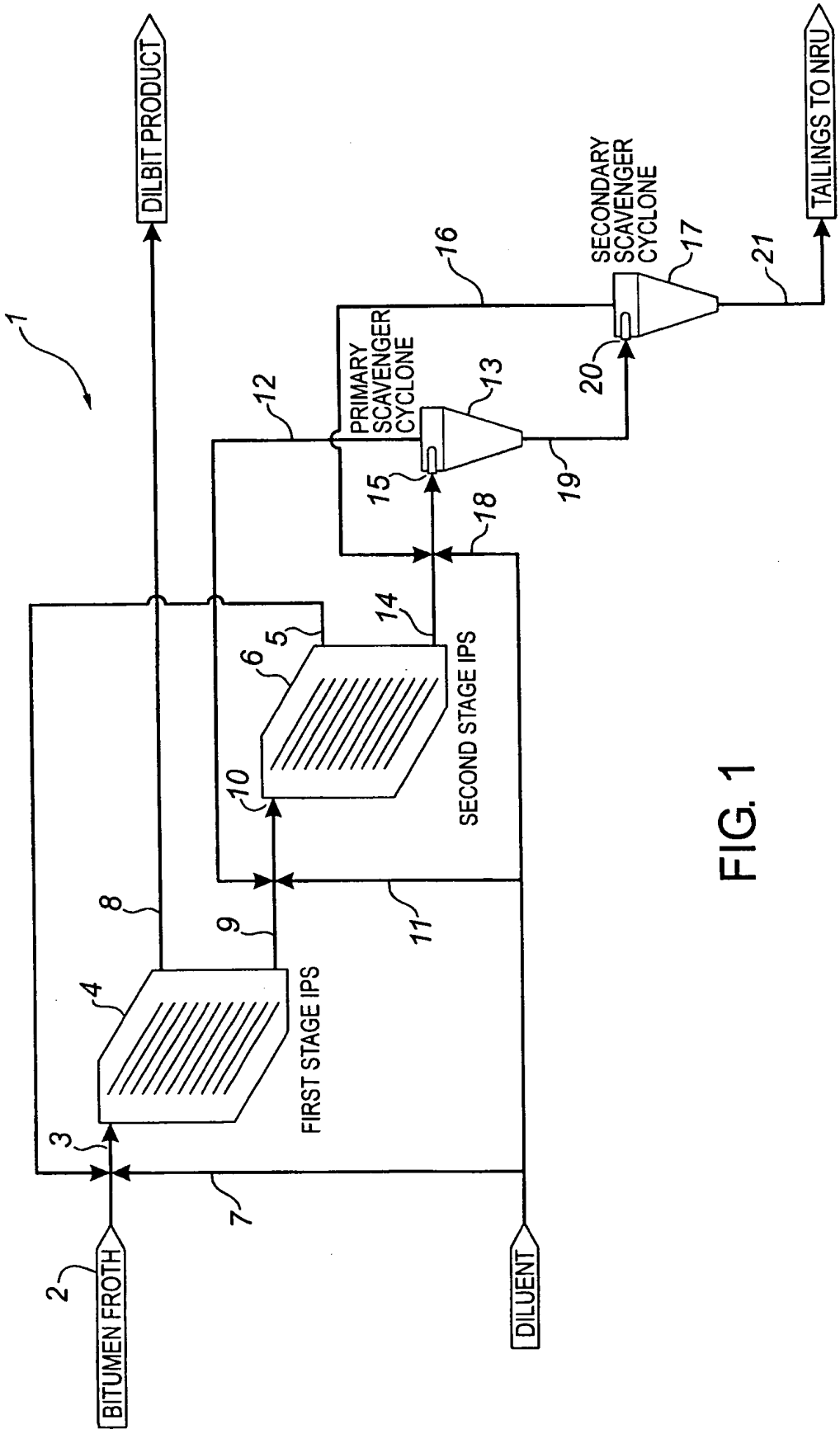

DILBIT PRODUCT
TAILINGS TO NRU
SECONDARY SCAVENGER CYCLONE
PRIMARY SCAVENGER CYCLONE
SECOND STAGE IPS
FIRST STAGE IPS
BITUMEN FROTH
DILUENT
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

FIG. 1